

Production Technology of Maize

Bangla name: Bhutta.

English name: Maize.

Scientific name: *Zea mays*.

Family: Gramineae.

Life cycle: 150-155 days.

Economic importance

It is used as human food, also as poultry feed and fodder crop. Alchole and edible oil is prepared from maize. Also prepared board paper.

Origin: Central America, Mexico and Pakistan.

Environmental Requirements

- It is a crop of warm weather.
- **Temperature:** 21⁰ C for germination and 32⁰ C for growth.
- **Rainfall:** 25-500 cm but sensitive to stagnant water.
- **Soil:** All type of soil but well drained sandy loam to loam soil is best.
- **pH :** 5.5-7.5.

Variety

Local variety: Savar, DMR, JC.

Improve variety: Bornaly (BARI maize 1), Suvro (BARI maize 2), Mohar, Ambercop (khoi bhutta), Suwan 1, Suwan 2, BARI bhutta 5, BARI bhutta 6.

Hybrid Variety: BARI Hybrid Bhutta 3, 8, 9, 10, 11.

Land preparation:

Land should be prepared 4-5 ploughing and laddering. The field should be properly leveled.

Fertilizer Application

- Urea: 275-300 kg/ha.
- TSP: 175-200 kg/ha.
- MoP: 100-125 kg/ha.

- Gypsum: 125 kg/ha.
- ZnSO₄: 10 kg/ha.

1/3 urea and all other fertilizer should be applied during final land preparation. 2/3 Urea are equally splited applied at 35-40 DAS and 65-70 DAS.

Sowing

Time: Robi: 15 October – 15 November.

Kharif-I: 15 February – April.

Kharif-II: July.

Method: 60-75 cm X 25-30 cm spacing. But it can be sown as broadcasting.

Depth: 25-35 cm.

Seed Rate: 25-30 kg for grain/ha.

50 kg for fodder/ha.

Seed Treatment: Seed should be treated with **Agrosan G.N.** and **Granosan M.**

Intercultural Operation

Gap filling: Gap filling is done at 7-10 DAS.

Thinning: When plant attain a height of 5-10 cm, it should be thinned out at 10-15 DAS.

Weeding: 2 weeding can be done.

Earthing Up: The soil in between the line should be earthup at the base of plants.

Irrigation: 2-3 irrigation are needed. 1st at 35-40 DAS, 2nd at 65-70 DAS and 3rd at 90-95 DAS.

Insect pest and disease Control

Important insect are *Ear worm*, *Borer*, *aphids*.

Control

- Seed should be treated with **Agrosan G.N.** and **Granosan M.**
- Use resistance variety.
- Spray crop with **Malathion 57 EC** or **Fifanon 57 EC** for Earworm and aphids.
- Spray **Sumithion/ Diazinon 57 EC** for borer.

Disease

Important disease are *Leaf blight*, *Maize streak*, *maize mosaic virus*.

Control

- Use resistance variety.
- Rough the infected plant.
- Spray **copper oxichloride/Macuprax**.

Harvesting

Maturity Symptoms

- Colour of crops become straw colour.
- Leaf become slightly yellow.
- Black spot are seen at the base of seed.
- Grain become hard.

Method: Mature crop should be harvested by hand and dried in the sun for 3-4 days. Finally the seeds are to be separated by corn sheller or hand or cattle.

Yield

- Local variety: 2-3 ton/ha.
- High yielding variety: 4-5 ton/ha.
- Hybrid variety: 5-6 ton/ha.
- 10,000 crop/ha for boiling or roasting.

Production Technology of Sorghum

Common name: great millet, durra, jowar, Sorghum.

Scientific name: *Sorghum bicolor*.

Family: Poaceae.

Origin: The origin of sorghum took place in North Eastern Africa.

Importance

Sorghum or jowar is one of the important food and fodder cereal crops. The nutritional value of sorghum is same as of that of corn and that is why it is gaining importance as livestock feed. Sorghum (or) Jowar is also used for ethanol production, producing grain alcohol, starch production, production of adhesives and paper other than being used as food and feed for livestock. Jowar (or) Sorghum cultivation is gaining popularity due to its nature of extreme drought tolerance. Sorghum is very nutritious just like corn and can be used as green fodder, dry fodder, hay or silage.

Varieties

Some Indian varieties are PC-6, 9, 23, HC- 171, 260 (Early to medium duration), U.P. Chari- 1 & 2, CO-27 etc.

Climate

Basically jowar or sorghum is a tropical crop. It thrives well at a temperature between 25°C and 32°C but below 16°C is not good for the crop. Jowar crop requires rainfall about 40 cm annually. Jowar is extreme drought tolerant crop and recommended for dry regions. Too much of moist and prolonged dry conditions are not suitable for jowar cultivation.

Soil

Sorghum crop adapts wide range of soils but grows well in sandy loam soils having good drainage. Soil pH range of 6 to 7.5 is ideal for its cultivation and better growth. The main field should be ploughed and leveled to fine tilth for weeds free sowing.

Land preparation

One should avoid rocky field and 1-2 ploughing followed by 2 crosswise harrowing are required to prepare a good seed bed.

Seed rate and sowing method

Seed rate of 35-40 kg per hectare is well enough and sowing should be carried out by drilling @ row-to-row distance of 25 cm. Seed broadcasting should be avoided. The seed should not be sowed more than 2–3 cm depth.

Fertilizer Application (1 Hectare of land)

- FYM – 10-15 tone.

At the time of sowing, basal application of-

- N – 60 Kg.
- P₂O₅ – 40 kg.
- K₂O – 40 kg.

Apply 35 kg N/ha top dressing 1 month after sowing. 60-65 kg N/ha should be applied in low rainfall and rainfed areas at sowing time. In Sulphur deficient soils, 45-60 kg S/ha should be added.

Irrigation

If the crop is sown in monsoon time (July), it may require 1 to 3 irrigations depending upon rains. For summer crops, 6 to 7 irrigations may be carried out due to high temperature. Rabi season crops need about 4 to 5 irrigations.

Critical stages of irrigation are- (For Rabi season)

- 30-45 days (seedling elongation stage).
- 60-65 days (reproductive or heading stages).
- 70-75 days (panicle emergence).
- 90-95 days (grain development stage).

However, if only one irrigation is available, this should be applied just before booting (40-50 days) from flowering at 10 days interval or Dithane M 45 – 0.2 % + Bavistin 0.2 % twice at 10 days interval after commencement of flowering.

Weed control

To control the weeds in Sorghum crop, weeder cum mulcher should be used to give 1 hoeing @ 3 weeks crop stage. Should use pre-emergence application of atrazine @ 0.50 kg/ha in 650 liters of water to control the weeds effectively.

Diseases and Insects

Sorghum crop prone to many insects and diseases. Insects/Pests in Sorghum are Stem borer, shootfly, & sorghum midge.

- Use spray of carbofuran/malathion @ 125 ml/ha, to control sorghum midge
- Use spray of endosulphan @ 0.075.

Diseases in Sorghum are Sooty stripe, anthracnose and zonate leaf spot.

- Spray carbendazim @ 5 grams /liter water to control anthracnose disease in early stages.
- Summer sown crop is very prone to shoot fly. For this carbofuran 3G @ 3 to 4 kg/ha should be applied to control shoot fly at sowing time.
- To control or avoid stem borers, crop should be sown during July season. Using spray of endosulfan @ 0.05% , 2 to 3 times at 10 to 14 days interval is also effective.

Harvesting

- The crop will be ready in single cut varieties for harvesting @ 65 to 75 days after sowing (50%,

flowering stage).

- In multi cut varieties, first cut should be done @ 45-50 days and subsequent cuts should be carried at 1 month intervals.

Yield

Good farm management practices and good variety of Sorghum/ Jowar can yield up 1000 kg/ha.

Production Technology of Napier grass

Common name: Napier grass, elephant grass, Uganda grass.

Scientific name: *Pennisetum purpureum*.

Family: Poaceae.

Napier grass is a leafy, branching, vigorous-growing perennial, attaining, under favorable conditions, a height of 10 to 15 feet at maturity. It has a strong, extensive fibrous root system which enables the plant to become quickly and permanently established in the soil. The leaf blades are usually 1 to 1½ inches wide and 2 to 3 feet long. seed heads which are golden yellow to tawny in color and from 5 to 10 inches in length.

Variety

Napier, Merker, French Cameroon, Uganda hairless, clone 13, Pakistan hybrid, umfufu (local variety in South Africa) etc.

Climate

Napier grass is truly a tropical species, but it is very adaptable in nature and can be grown successfully in the subtropics and even in the warmer sections of the Temperate Zone. It can be grown at altitudes ranging from sea level to 2,000 m above sea level. When grown at altitudes above 2000 m, growth and regeneration after cutting is slow and it may die due to frost. It does best in high rainfall areas, over 1500 mm per year.

Soil

Napier grass has been grown successfully on a wide range of soil types in various parts of the world. but does best in deep, fertile, well draining soils.

Land Preparation

Although Napier grass is aggressive and perennial in nature, competing very well with most weeds, it becomes well established in perfect stands only if planted in a thoroughly prepared seed bed. On new land or land that has been out of cultivation for some years, several plowing may be necessary. This

procedure of ploughing and disking should be repeated once, twice or more if necessary.

Planting

Time: Plant at the beginning of the main (reliable) rainy season. Either canes or splits can be used for propagation. Canes require less labour and planting material. While splits are labour intensive and requires a lot of planting material.

Materials: Napier grass is propagated largely by vegetative means, either using stalk cuttings or root-clump divisions. Well-developed hard stalks are best, not less than 3 or 4 months of age and not older than 8 to 12 months.

Planting Method

- Napier grass should be planted in rows.
- Spacing to adopt depends on moisture availability/rainfall.
- Recommendation for high rainfall areas is 90 by 60 cm or 100 by 50 cm.
- Recommendations for the low rainfall areas are 100 by 100 cm or 100 by 120 cm.
- Planting holes of 15 – 20 cm deep are recommended for farmers using cuttings and splits.
- Farmers using whole cane are advised to dig furrows of 10 – 15 cm deep.

Method of propagation

1. Cuttings Style

- Cane cuttings are placed at an angle of 45° inside the planting holes.
- Care should be taken to ensure that at least 2 nodes are within the soil.
- The buds of the cuttings should face up and should not be damaged.
- 11236 cuttings are required for planting per acre

2. Splits Style

- Splits are placed within the planting holes and firmly put in the soil.
- 14045 splits are required for planting per acre.

3. Cane Style

- Cane are laid end to end in the furrow and covered with soil.

Fertilizer and Manuring

Planting time

- 1 bag of 50 kgs of NPK (20:20:0) is applied at planting per acre.
- One spade full of farm yard manure can be applied in the planting holes at planting time.

Top dressing

- Apply two 50 kgs bags of NPK 20:20:0 per acre in the middle of the long rains.
- Another two 50 kgs bags of NPK 20:20:0 at the onset of short rains.
- Alternatively apply 30 kg of CAN at the beginning and another 30 kgs in the middle of the long rains. 40 kgs of CAN should be applied in the course of the short rains.
- Slurry (mixture of dung & urine) can be applied immediately after harvesting in a furrow along the rows of Napier and covered with soil as weeding is also done.

Intercropping

Napier grass can be intercropped with various legume crops and shrubs. Intercropping with legumes improves the quality of the fodder and soil fertility.

Weed Control

After planting a new crop of Napier is kept clean of weeds by Carrying out a minimum of two weeding (3 weeks after planting then 3 or 4 after the first weeding) before first harvest.

Irrigation

Irrigation is essential for high yields. A furrow system is quite satisfactory, applying water about every 10 days during the dry weather.

Disease

Important disease are Head Smut, Napier Stunting Disease, Snow Mould Fungal Disease etc.

Control

- Avoid using manure from livestock fed on smut infected plants.
- Use of clean planting materials.
- Uprooting and burning of affected materials.
- Observe routine agronomic measures.

- Use resistant varieties

Harvesting

- The first cutting is expected 3 – 4 months after planting (when at one meter high).
- At first harvesting it is recommended that the cutting be done at a height of 5 cm from the soil/ground. This is to allow for more growth of new shoots.
- Cutting intervals usually depend on rainfall availability and the level of management.
- Successive harvests should be done when the crop is 1.5 meters.
- Napier should be cut 5 cm from the ground.

Yield

Expected yield is 20,000 to 40,000 kg of fresh Napier per acre.

[Note: the yield depends of the level of management.]

Production Technology of Guinea Grass

Common name: Guinea grass, green panic grass.

Scientific name: *Megathyrsus maximus*.

Family: Poaceae.

Guinea grass is indigenous to tropical Africa. It is a tall (1-4.5 m), tufted and fast growing highly palatable perennial grass. It has short creeping rhizome. Establishes readily by seed or plantation of rooted slips. Crude protein ranges from 4 to 14%.

Variety

Hamil, PPG -14, Makuni, Rivers-dale, CO 1, CO 2 etc.

Climate

Throughout the year under irrigated conditions. Suitable for growing during monsoon season under rainfed condition.

Soil

All types of soil with good drainage. Does not come up well on heavy clay soil or flooded or waterlogged conditions.

Land preparation

Plough 2 to 3 times to obtain a good tilth and form ridges and furrows 50 cm apart.

Seed Rate

- Seed: 2.5 kg/ha.
- Rooted: Slips 40,000 /ha.

Spacing

50 X 30 cm.

Fertilization

Basal Application-

- FYM – 25 tonnes/ha.
- N – 50 kg/ha.
- P₂O₅ – 50 kg/ha.
- K₂O – 40 kg/ha.

Top dressing-

- 50 kg N 30 days after planting.
- 25 kg N/ha after each cut.

Weeding

First hoeing and weeding on 30 day after germination. Earthing up once in three harvests.

Irrigation

Once in ten days or depending upon soil condition. Immediately after planting, life irrigation on 3rd Day and thereafter once in 10 days depending on soil type and weather parameters.

Plant protection

Generally not needed

Harvesting

The first harvest 75 - 80 days after planting and subsequent harvests are made at an interval of 40 - 45 days.

Yield

320 t/ha/year (in 7 harvests).

Production Technology of Para grass

Common name: para grass, buffalo grass, Carib grass, Scotch grass etc.

Scientific name: *Brachiaria mutica*.

Family: Poaceae.

Paragrass is a short-culmed, stoloniferous perennial up to 200 cm high with long, hairy leaf-blades about 16 mm wide. Panicle 10-20 cm long with solitary racemose or compound branches and glabrous, acute, irregularly multiseriate spikelets 3-3.5 mm long.

Variety

There is no recommended variety.

Climate

It is a perennial grass suitable for cultivation in humid areas. It is grown in seasonally flooded valleys and lowlands and can withstand water logging and long term flooding. Adapted to high-rainfall tropical and subtropical conditions, but in protected areas it can persist with rainfall as low as 900 mm per year. Optimum temperature for growth 21°C. Minimum temperature for growth 15°C

Soil

It cannot grow on dry lands in arid or semi arid areas. Water logged soils are best suited for this crop. It can be grown on sandy soils also, provided water supply is sufficient.

Land Preparation

An initial ploughing may be necessary for a rough seed-bed in cleared land. Sprigs can be hand planted in the ashes of burnt wet sclerophyll forest or rain forest or can be directly planted into swampy land.

Planting

Materials: Seed setting is very poor in this grass. It is propagated exclusively by stem cuttings.

Time: It can be planted at any time but June - July planting is advisable under rainfed.

Method: Stems with 2-3 nodes are planted in 45-60 cm rows at 20 cm spacing. The stems are pressed into wet soil leaving the two ends sticking up.

Seed rate

800-1000 kg of stem cuttings are needed for planting one hectare.

Fertilizer Application

It responds readily to nitrogen. On phosphorus-deficient soils a dressing of 500 kg/ha should be applied prior to planting with subsequent top-dressings of 120-250 kg/ha per year for a few years. Nitrogen applied toward the end of summer or in autumn will give better winter growth. It tolerates high aluminium.

Diseases

It is relatively free of diseases. Coccid bug attack associated with sooty mould fungus (*Capnodium* sp.) causes damage to young leafy shoots. Blast (*Piricularia* sp.) and sheath blight (*Rhizoctonia* sp.) occur in Thailand.

Harvesting

The first cut is taken 75-80 days after planting and the subsequent cuts at 40-45 days interval.

Yield

Totally, 6-9 cuts can be taken in a year with an average green fodder yield of 80-100 t/ha.